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EXAMINER

KIM, DAVID S

ART UNIT PAPER NUMBER

2633

DATE MAILED: 03/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/560,723

Applicant(s)

WATANABE, SHIGEKI

Examiner

David S. Kim

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 April 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## **DETAILED ACTION**

### ***Drawings***

1. The drawings are objected to because character "38" in Fig. 7 does not seem to properly indicate the location of "splitting point" as discussed on page 20. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.
2. Applicant is required to submit a proposed drawing correction in reply to this Office action. However, formal correction of the noted defect may be deferred until after the examiner has considered the proposed drawing correction. Failure to timely submit the proposed drawing correction will result in the abandonment of the application.

### ***Specification***

3. The abstract of the disclosure is objected to because of its undue length. Correction is required. See MPEP § 608.01(b).
4. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

5. The disclosure is objected to because of the following informalities: on page 9, line 18, it seems that "rasing" is used where "lasing" may be intended.

Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Claims 1-3, 5, 9, 11-17** are rejected under 35 U.S.C. 102(b) as being anticipated by Bigo et al. 10/97 ("All-optical fiber signal processing and regeneration for soliton communications").

**Regarding claim 1**, Bigo et al. 10/97 discloses:

An optical device (Fig. 9) comprising:

an optical path (path from data input to clock output in Fig. 9) provided between an input port (data input in Fig. 9) to which signal light modulated at a frequency  $f_s$  (pp. 1215, col. 1, 2<sup>nd</sup> paragraph) is supplied and an output port (clock output in Fig. 9); and

an optical loop (loop in Fig. 9) optically coupled to said optical path;

said optical loop comprising:

an optical amplifier (EDFA in loop in Fig. 9) for compensating for a loss in said optical loop so that laser oscillation occurs in said optical loop;

an adjuster (optical delay line in Fig. 9, pp. 1215, col. 1, 1<sup>st</sup> paragraph) for adjusting an optical path length of said optical loop so that said frequency  $f_s$  becomes equal to an integral multiple of the reciprocal of a recirculation period of said optical loop; and

a nonlinear optical medium (pp. 1214, col. 2, last paragraph – pp. 1215, col. 1, 1<sup>st</sup> paragraph) for mode-locking said laser oscillation according to said signal light.

**Regarding claim 2**, Bigo et al. 10/97 discloses:

An optical device according to claim 1, wherein said optical loop further comprises an optical bandpass filter (filter in loop in Fig. 9) having a passband including the wavelength of said laser oscillation.

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**Regarding claim 3,** Bigo et al. 10/97 discloses:

An optical device according to claim 1, further comprising an optical coupler (50/50 coupler in Fig. 9) for optically coupling said optical path and said optical loop, said optical coupler providing a part of said optical path and a part of said optical loop.

**Regarding claim 5,** Bigo et al. 10/97 discloses:

An optical device according to claim 1, wherein said nonlinear optical medium comprises a semiconductor optical amplifier (SOA in Fig. 9).

**Regarding claim 9,** Bigo et al. 10/97 discloses:

An optical device according to claim 1, further comprising an input optical amplifier (EDFA connected to data input in Fig. 9) optically connected to said input port for amplifying said signal light.

**Regarding claim 11,** Bigo et al. 10/97 discloses:

An optical device according to claim 1, further comprising an optical bandpass filter (filter connected to clock output in Fig. 9) optically connected to said output port and having a passband including a wavelength of light obtained by said laser oscillation.

**Regarding claim 12,** Bigo et al. 10/97 discloses:

An optical device according to claim 1, further comprising a waveform shaper (NOLM in Fig. 11) optically connected to said output port for performing waveform shaping of said signal light according to an optical clock output from said output port.

**Regarding claim 13,** Bigo et al. 10/97 discloses:

An optical device according to claim 12, wherein said waveform shaper comprises a nonlinear optical loop mirror (NOLM in Fig. 11).

**Regarding claim 14,** claim 14 is a system claim that corresponds largely to the device claim 1. Therefore, the recited means in device claim 1 read on the corresponding means in system claim 14. Claim 14 also includes a limitation absent from claim 1. This limitation is:

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an optical fiber transmission line for transmitting signal light modulated at a frequency  $f_s$ .

Bigo et al. 10/97 also discloses such a transmission line (line connected to "1:2 clock recovery" unit in Fig. 11).

**Regarding claims 15-16**, claims 15-16 are system claims that correspond largely to the device claims 12-13, respectively. Therefore, the recited means in device claims 12-13 read on the corresponding means in system claims 15-16. Claims 15-16 also include limitations absent from claims 12-13. These limitations are also disclosed by Bigo et al. 10/97:

an optical fiber transmission line (optical fiber link on pp. 1216, col. 1, last paragraph) for transmitting signal light; and

at least one optical repeater (amplifier on pp. 1216, col. 2, 1<sup>st</sup> paragraph) arranged along said optical fiber transmission line;

each of said at least one optical repeater comprising:

an optical clock regenerator (Fig. 9., pp. 1216, col. 2, 1<sup>st</sup> paragraph) for regenerating an optical clock by mode locking of laser oscillation according to said signal light.

**Regarding claim 17**, claim 17 is a method claim that corresponds to device claim 1. Therefore, the recited means in device claim 1 read on the corresponding steps in method claim 17.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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8. **Claim 4 and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigo et al. 10/97.

**Regarding claim 4**, Bigo et al. 10/97 discloses:

An optical device according to claim 1, wherein:

amplitude modulation (pp. 1220, col. 2, last paragraph) is performed in said nonlinear optical medium using said signal light as pump light.

Bigo et al. 10/97 does expressly disclose:

said nonlinear optical medium comprises a third-order nonlinear optical medium; and  
said amplitude modulation is performed by four-wave mixing.

However, Examiner takes Official Notice that the nonlinear optical medium of Bigo et al. 10/97 (SOA in Fig. 9, pp. 1214, col. 2, last paragraph – pp. 1215, col. 1, 2<sup>nd</sup> paragraph) inherently comprises a third-order nonlinear optical medium.

Additionally, Examiner takes Official Notice that amplitude modulation performed in a nonlinear optical medium by four-wave mixing is known and conventional in the art. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to perform the amplitude modulation of Bigo et al. 10/97 in the nonlinear optical medium of Bigo et al. 10/97 by four-wave mixing. One of ordinary skill in the art would have been motivated to do this since amplitude modulation in a nonlinear optical medium performed by four-wave mixing is an all-optical process, and “all-optical implementation is attractive because it removes the electronics bottleneck” (Bigo et al. 10/97, pp. 1220, col. 2, 1<sup>st</sup> paragraph under Section V).

**Regarding claim 10**, Bigo et al. 10/97 discloses all the limitations of claim 10 except for:

an optical bandpass filter optically connected between said input port and said input optical amplifier and having a passband including a wavelength of said signal light.

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However, Bigo et al. 10/97 does teach such a filter used at a different location (filter in Fig. 3, pp. 975, col. 2, paragraph after Fig. 3). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to place another instance of this filter of Bigo et al. 10/97 between said input port and said optical amplifier of the device of Bigo et al. 10/97. One of ordinary skill in the art would have been motivated to do this “to remove excess amplifier noise” (pp. 975, col. 2, paragraph after Fig. 3).

9. **Claims 6 and 8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Bigo et al. 10/97 as applied to claims 1 and 14 above, and further in view of Smith et al. (“All-optical clock recovery using a mode-locked laser”).

**Regarding claim 6**, Bigo et al. 10/97 discloses all the limitations of claim 6 except for: said nonlinear optical medium comprising a single-mode fiber.

Bigo et al. 10/97 does disclose said nonlinear optical medium comprising a Kerr fiber modulator (Bigo et al. 10/97, KFM on pp. 1215, col. 1, 1<sup>st</sup> paragraph) of Smith et al. The KFM of Smith et al. comprises a fiber with a zero-dispersion wavelength around 1.545  $\mu\text{m}$  (Smith et al., pp. 1815, col. 2, 1<sup>st</sup> paragraph). Such a fiber is also known as dispersion-shifted fiber, which is a type of single-mode fiber. Thus, the KFM of Smith et al. comprises a single-mode fiber. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to utilize the KFM of Smith et al. as the nonlinear optical medium of Bigo et al. 10/97. One of ordinary skill in the art would have been motivated to do this since KFM’s provide high bandwidth potential (Bigo et al. 10/97, pp. 1215, col. 1, 1<sup>st</sup> paragraph).

**Regarding claim 8**, Bigo et al. 10/97 discloses all the limitations of claim 8 except for: said nonlinear optical medium having a zero-dispersion wavelength substantially equal to the wavelength of said signal light.

Bigo et al. 10/97 does disclose said nonlinear optical medium comprising a Kerr fiber modulator (Bigo et al. 10/97, KFM on pp. 1215, col. 1, 1<sup>st</sup> paragraph) of Smith et al. The KFM of



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Smith et al. comprises a fiber with a zero-dispersion wavelength substantially equal to the wavelength of said signal light (Smith et al., pp. 1815, col. 2, 1<sup>st</sup> paragraph). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to utilize the KFM of Smith et al. as the nonlinear optical medium of Bigo et al. 10/97. One of ordinary skill in the art would have been motivated to do this since KFM's provide high bandwidth potential (Bigo et al. 10/97, pp. 1215, col. 1, 1<sup>st</sup> paragraph).

10. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Bigo et al. 10/97 as applied to claim 1 above, in view of Bigo et al. 10/95 ("20 GHz all-optical clock recovery based on fiber laser mode-locking with fiber nonlinear loop mirror as variable intensity/phase modulator"), and further in view of Pastel et al. ("High nonlinearity, low loss fiber for 1 pJ switching of 8-ps optical pulses"). Bigo et al. 10/97 discloses all the limitations of claim 7 except for:

said nonlinear optical medium comprising a highly nonlinear dispersion shifted fiber.

Bigo et al. 10/97 does disclose said nonlinear optical medium comprising a nonlinear optical loop mirror (Bigo et al. 10/97, NOLM on pp. 1215, col. 1, 1<sup>st</sup> paragraph) of Bigo et al. 10/95. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to utilize the NOLM of Bigo et al. 10/95 as the nonlinear optical medium of Bigo et al. 10/97. One of ordinary skill in the art would have been motivated to do this NOLM's provide high bandwidth potential (Bigo et al. 10/97, pp. 1215, col. 1, 1<sup>st</sup> paragraph).

Bigo et al. 10/97 in view of Bigo et al. 10/95 still does not disclose:

said nonlinear optical medium comprising a highly-nonlinear dispersion shifted fiber.

However, Pastel et al. teaches a NOLM comprising a highly nonlinear dispersion shifted fiber. At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to utilize highly nonlinear dispersion shifted fiber in the NOLM of Bigo et al. 10/97 in view of Bigo et al. 10/95. One of ordinary skill in the art would have been motivated to

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do this since "highly nonlinear optical fiber combined with low attenuation enables improved nonlinear optical loop mirrors (NOLM) performance with shorter fiber lengths, lower switching energies and/or an increased switching window" (Pastel et al., pp. 168, col. 1, 1<sup>st</sup> paragraph). Thus, the device of Bigo et al. 10/97 in view of Bigo et al. 10/95, further in view of Pastel et al. discloses said nonlinear optical medium comprising a highly-nonlinear dispersion shifted fiber.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Avramopoulos et al. is cited to show a related waveform shaper comprising a nonlinear optical loop mirror. Watanabe (U.S. Patent No. 5,596,667) is cited to show related nonlinear optical media and modulation performed in such media. Bigo et al. 5/97 is cited to show a related optical device. Ellis et al. is cited to show a related optical device that uses dispersion-shifted fiber as a related nonlinear optical medium. Obro et al. is cited to show a related optical device and system that uses dispersion-shifted fiber as a related nonlinear optical medium. Patrick et al. is cited to show a related optical device that uses a semiconductor optical amplifier as a related nonlinear optical medium. Watanabe et al. is cited to show highly nonlinear dispersion shifted fiber as a related nonlinear optical medium.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Kim whose telephone number is 703-305-6457. The examiner can normally be reached on Mon.-Fri. 9 AM to 5 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 703-305-4729. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4750.

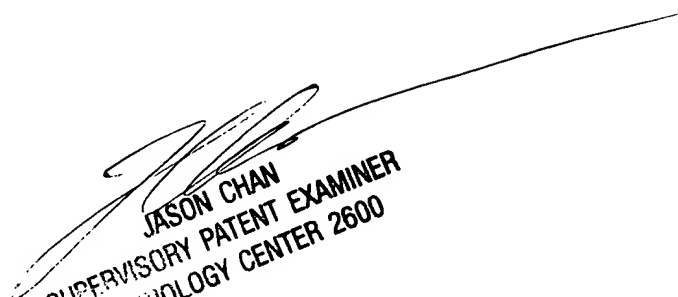
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DSK

March 21, 2003



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